

Storm Water Treatment Devices as Potential Breeding Grounds for Disease Carriers

California Department of Health Services:
Vector-Borne Disease Section



The Vector Problem

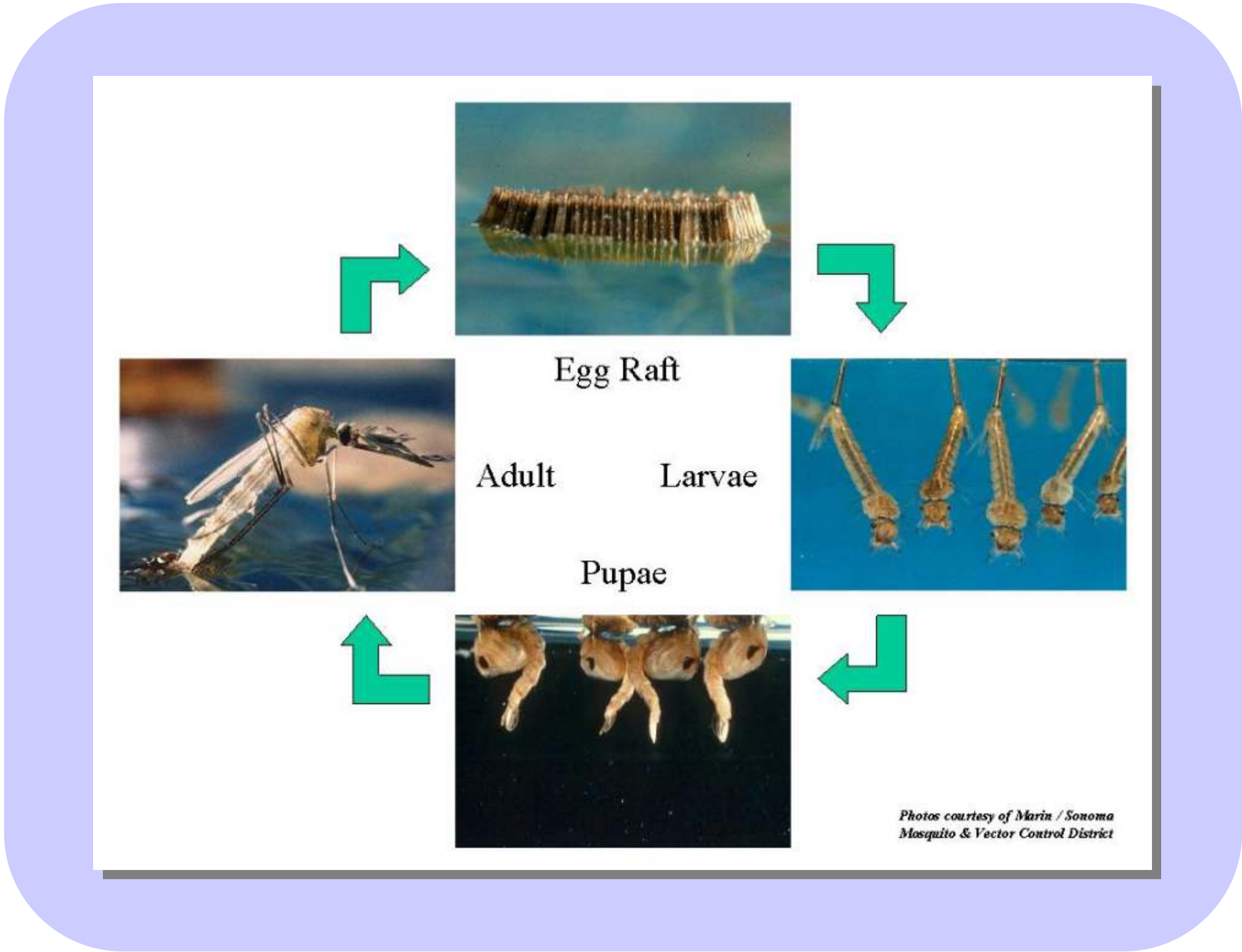
- In biological terms, a "vector" refers to any organism that can transmit an infectious disease pathogen to another organism. Infections acquired from vectors are referred to as "vector-borne" diseases.
- Structural Best Management Practices (BMPs) are treatment devices used to improve storm water runoff water quality.
- Many BMP designs retain water and provide habitat for vectors, particularly mosquito larvae.
- It takes as few as 3 days for mosquitoes to develop in standing water, even in very small pools.
- Mosquitoes can carry a variety of non-fatal and fatal diseases.
- With the implementation of new environmental regulations, thousands of new BMPs may be constructed, creating more mosquito habitats.
- The Vector-Borne Disease Section, in cooperation with Caltrans, and local vector control agencies has studied the production of mosquitoes at BMP sites.

Study Objectives

- Develop a better understanding of vectors associated with structural BMPs.
- Identify habitats suitable for vector breeding present within BMPs.
- Monitor mosquito breeding in BMPs weekly (May 99 - April 01).
- Recommend modifications for BMPs to minimize or eliminate vector breeding.
- Evaluate the short-term success of "mosquito-proofing" efforts used to mitigate problem areas.

The Biology of Mosquitoes

- Mosquitoes are the world's most dangerous vectors. Diseases transmitted by mosquitoes are responsible for the deaths of millions of people every year, as well as millions of non-fatal infections that cause severe and debilitating illness.



- Mosquitoes undergo a "complete metamorphosis" from aquatic immature stages (larvae and pupae) to winged adults, in as little as 3 days. Eggs are laid in or near water. Larvae feed on microscopic items such as bacteria, grow rapidly, become pupae, and emerge from pupae as winged adults.

Sampling

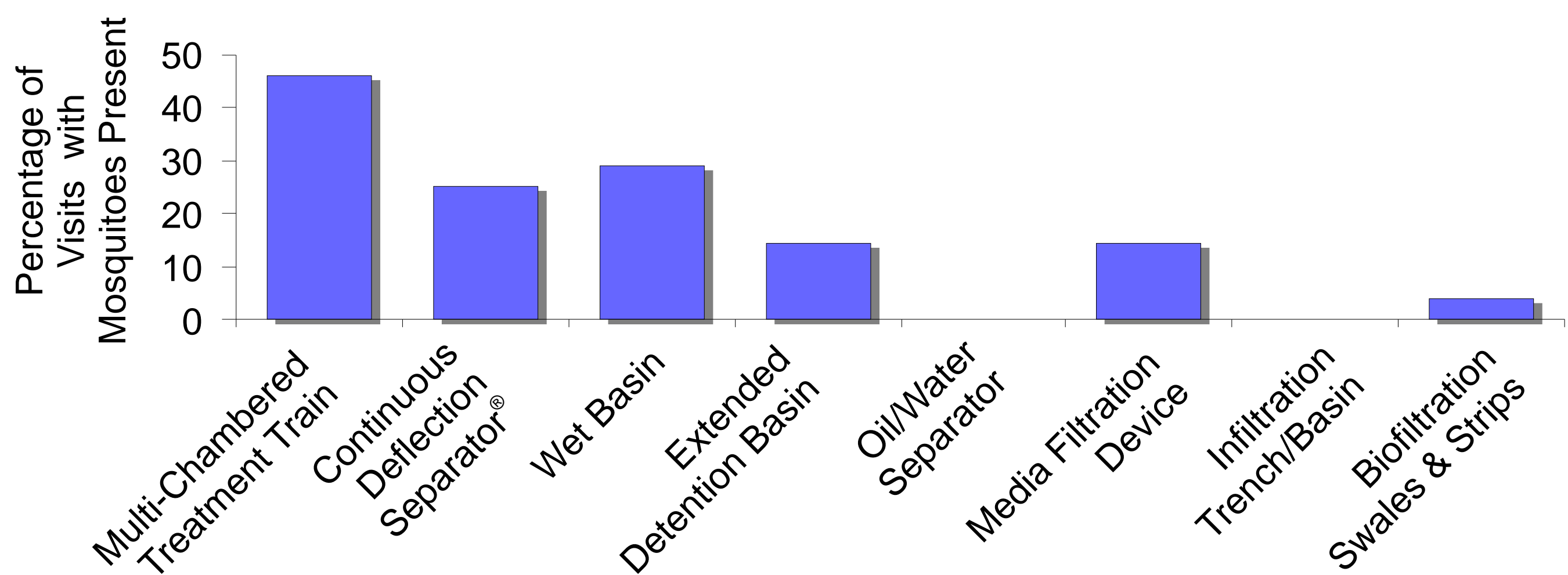


Mosquito data was obtained weekly using a standardized collection tool: the “Mosquito Dipper”.



If immature mosquitoes were discovered in a “dip sample”, they were:

- Counted
- Examined for developmental stages
- Identified to species



BMPs that maintained permanent sumps or basins of standing water (i.e. MCTT, CDS®, and the wet basin) provided suitable habitat for immature mosquitoes, and frequently supported large populations relative to other structural designs.

Mosquito Breeding Habitats Created by BMPs



Retention Ponds



Spreader Troughs



Below-Ground Covered Sumps, Catch Basins, and Settling Basins



Rip-Rap



Exposed Catch Basins and Settling Basins

Solutions Developed: An Ongoing Process



Problem: The design of certain biofiltration swales in Los Angeles County included concrete depressions for rip-rap energy dissipaters. These held standing water for weeks and provided suitable habitat for hundreds of mosquito larvae.

Solution: Filled depressions with concrete and embedded rocks into it. This allowed for energy dissipation while eliminating the mosquito habitat.



Problem: Certain Austin-type sand media filters in Los Angeles County were designed with below-ground sumps that required pumping. The underground sumps were easily accessible to mosquitoes through 3-foot diameter stand pipes and provided suitable habitats for mosquito larvae.

Solution: Heavy cloth "mosquito screens" were fitted on the sump stand pipes. *Note:* Mosquito screens must be inspected for holes and replaced frequently.



Problem: Emergent vegetation such as cattails can rapidly overrun and clog retention ponds and constructed wetlands that are not over 4 feet deep. This site in San Diego County loses over 50% of its surface area to invasive cattails that fill all but the deepest sections of the pond.

Solution: Annual removal of cattails is necessary to reduce vector production (mosquito larvae can hide from predators such as fish in dense vegetation) and maintain the function of the BMP.



Problem: The multi-chambered design of multi-chambered treatment train media filter devices prevented all but the last few feet of water to be pumped from the sedimentation chamber to the sand media chamber. The remaining water stagnated for months and provided habitat for mosquito larvae.

Solution: A sealed (smoke proof) aluminum cover was retrofitted over the sedimentation chamber.



Problem: CDS devices have a permanent, below-ground sump where trash and debris are separated from incoming storm water runoff. In addition, a covered weir box with a depression held water. The water was accessible to mosquitoes from many entrance points and provided suitable habitat for thousands of mosquito larvae.

Solution: Extensive mosquito-proofing efforts were undertaken that included filling the weir box depression with grout, sealing the sump and weir box lids with foam, and installing fine-mesh nets on the effluent pipe.



Problem: A concrete-lined extended detention basin incorporated a sump with an outlet pipe placed about 18 inches above the invert of the inlet pipe, resulting in a permanent source of standing water suitable for mosquito breeding.

Solution: The inlet was modified so the sump could be filled to the same level as the outlet pipe.

Other Problems Associated with BMPs



Invasive Vegetation
Vegetation can rapidly overtake neglected BMPs. Large trees became established in the concrete-lined influent channel of this extended detention basin in Austin, Texas.



Clogging
Sediment, trash, and other debris can completely incapacitate certain BMP designs. This huge Austin-type sand media filter in Austin, Texas was completely clogged, forming a small lake.



Incomplete Drainage
Except for those BMPs that are designed to hold permanent water (i.e. retention ponds), all should drain completely to effectively suppress vector production, preferably in 72 hours or less.

Left: This extended detention basin in Austin, Texas, maintained a permanent pool of water near the influent pipe because of a low area caused by erosion.

Right: An extended detention basin in Portland, Oregon, with its outlet placed high above the basin floor. This created a permanent pool of standing water.



Debris Build-Up
Deposition of silt and debris can result in pools of standing water over time.

Left: This is the influent pipe leading from a freeway interchange into a biofiltration swale in Los Angeles County. The debris accumulated over the course of only one year.

Right: Vegetation and sediment build up at the influent pipe of this extended detention basin in San Diego County will eventually create a pool of standing water.



Drainage Slopes
Left: Improper, uneven, or inadequate drainage slopes can result in standing water, as seen in the concrete-lined settling basin of this Austin-type sand media filter in Los Angeles County. The water stands in a low spot opposite from the effluent pipe.

Right: Water stands along the length of this inadequately sloped, soil-lined influent channel of a Austin-type sand media filter in Austin, Texas.



Access

Access for routine maintenance and vector control is imperative in BMP design. These two extended detention basins in Portland, Oregon, were constructed with 1:1 slopes, making access very difficult and dangerous, and essentially prevented the use of maintenance equipment such as small front-loaders.

This retention pond in Portland, Oregon was built without a perimeter access road or trail. Blackberry vines created an effective "barbed wire" barrier around most of the pond, preventing effective vector monitoring and abatement.

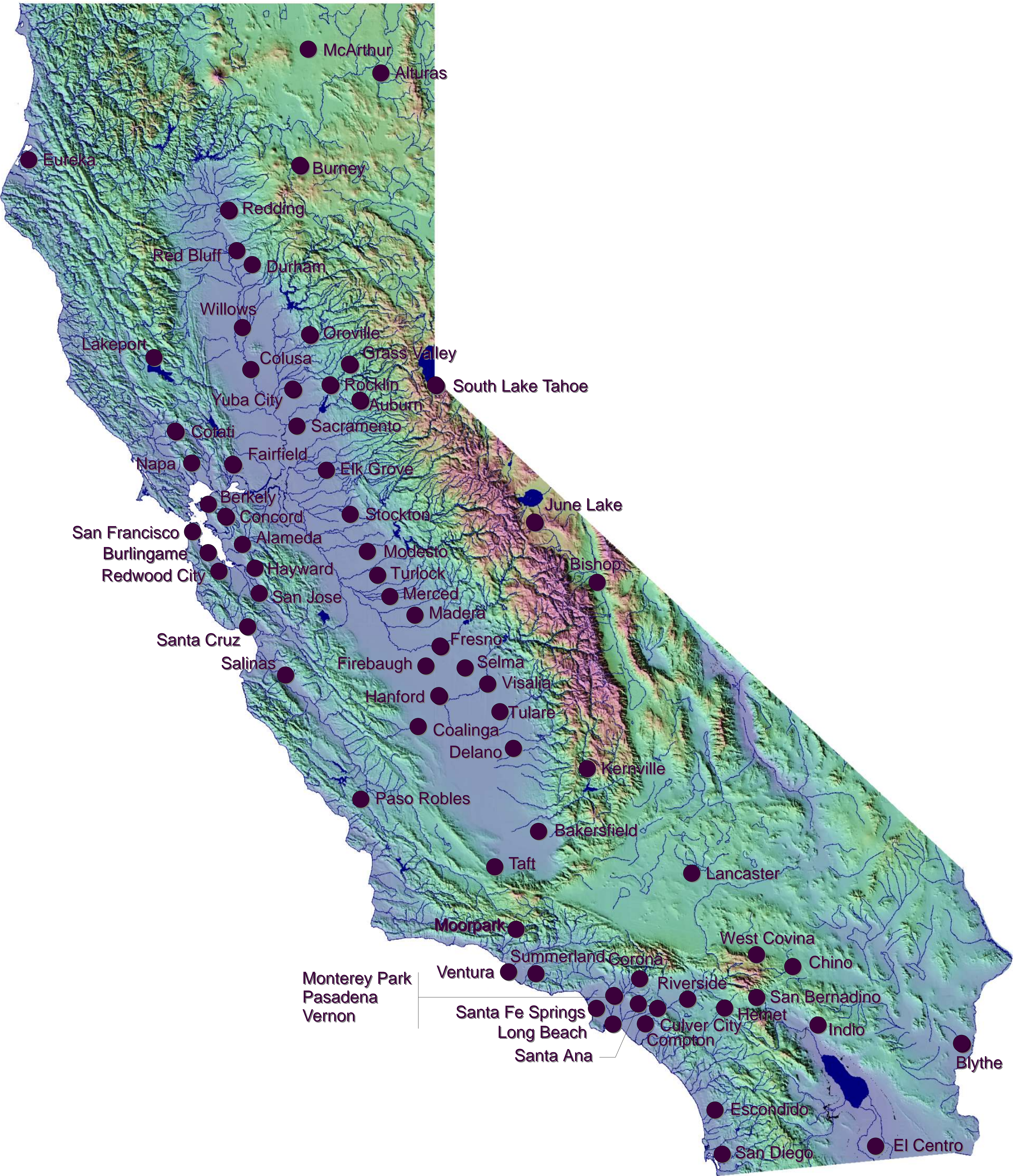


Urban Non-Stormwater Runoff

Urban non-stormwater runoff from irrigation systems, people washing cars, etc. can affect the intended drying time of certain BMP designs. These multi-purpose extended detention basins/parks in La Quinta, California, maintained semi-permanent pools of standing water, despite being in an arid desert environment. This was a result of intensive lawn irrigation runoff from local homes.

California Vector Control Programs

District Offices



 If you have questions or concerns about vectors contact your local Vector Control Program or County Public Heath Office.

Acknowledgements

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